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(54) **LIQUID CRYSTAL DISPLAY**

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G02F 1/1362	(2006.01)
G02F 1/1368	(2006.01)
G02F 1/1333	(2006.01)

(52) **U.S. Cl.**

CPC ***G02F 1/136286*** (2013.01); ***G02F 1/1368*** (2013.01); ***G02F 1/133345*** (2013.01); ***G02F 1/136209*** (2013.01); ***G02F 1/136227*** (2013.01); *G02F 2001/136218* (2013.01); *G02F 2001/136222* (2013.01)

(58) **Field of Classification Search**

CPC G02F 1/136259; G02F 2001/136263; G02F 2001/136272; G02F 2001/1357; G02F 2001/136218; G02F 1/136204; G02F 1/136218

See application file for complete search history.

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(57) **ABSTRACT**

A liquid crystal display includes: gate and data lines; a thin film transistor connected to the gate and data lines; a pixel electrode connected to the thin film transistor, including first and second sub-pixel electrodes; a shielding electrode member on the data line, including first and second shielding electrodes respectively at opposing sides of the pixel electrode, each shielding electrode including: an expanded part between the first and second sub-pixel electrodes, and a vertical part elongated from the expanded part in a first direction parallel to the data line; and a light blocking member elongated in a second direction crossing the first direction, overlapping the thin film transistor A second direction width of the expanded part is larger than that of the vertical part, and opposing edges of the expanded part overlap the elongated light blocking member overlapping the thin film transistor.

19 Claims, 8 Drawing Sheets

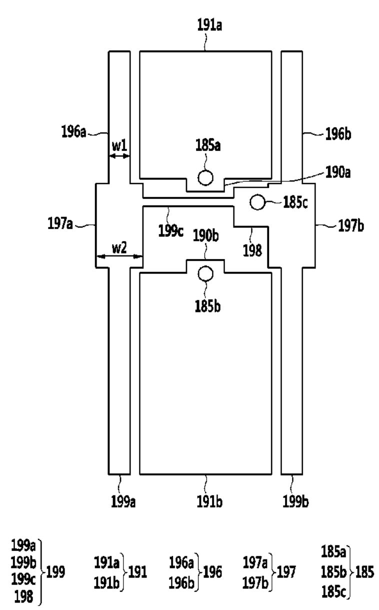
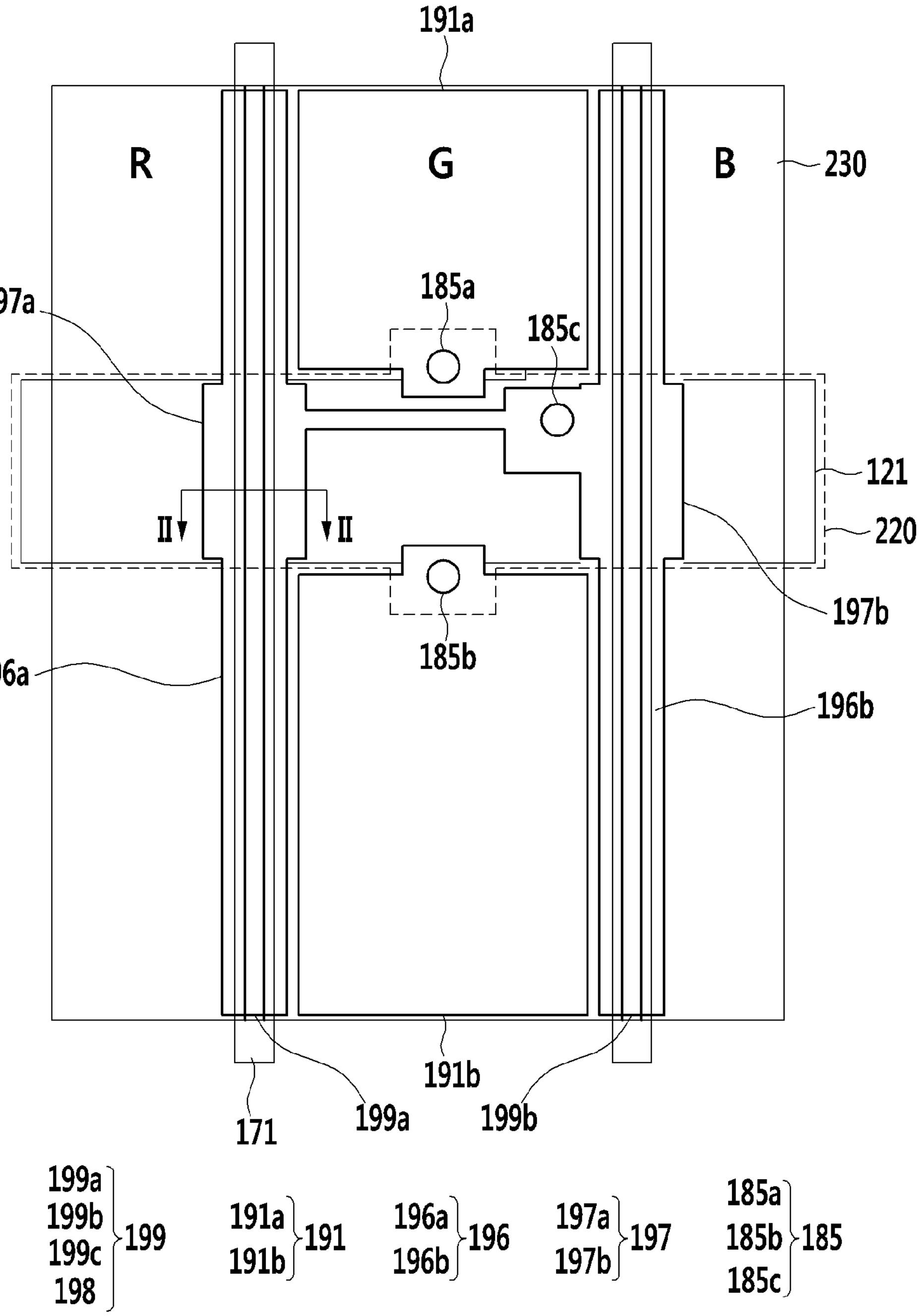


FIG. 1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B
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199b
171
199a
199b
199c
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FIG. 2

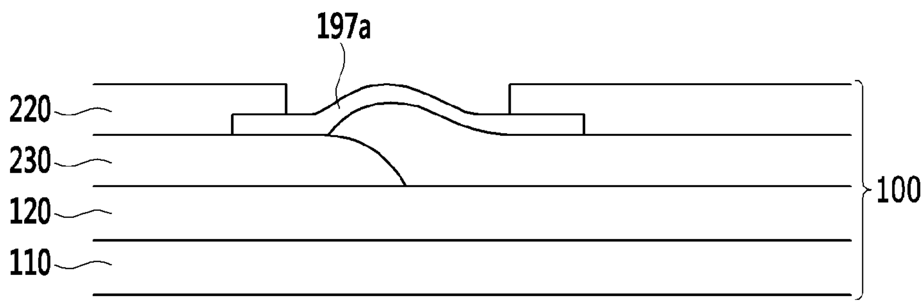
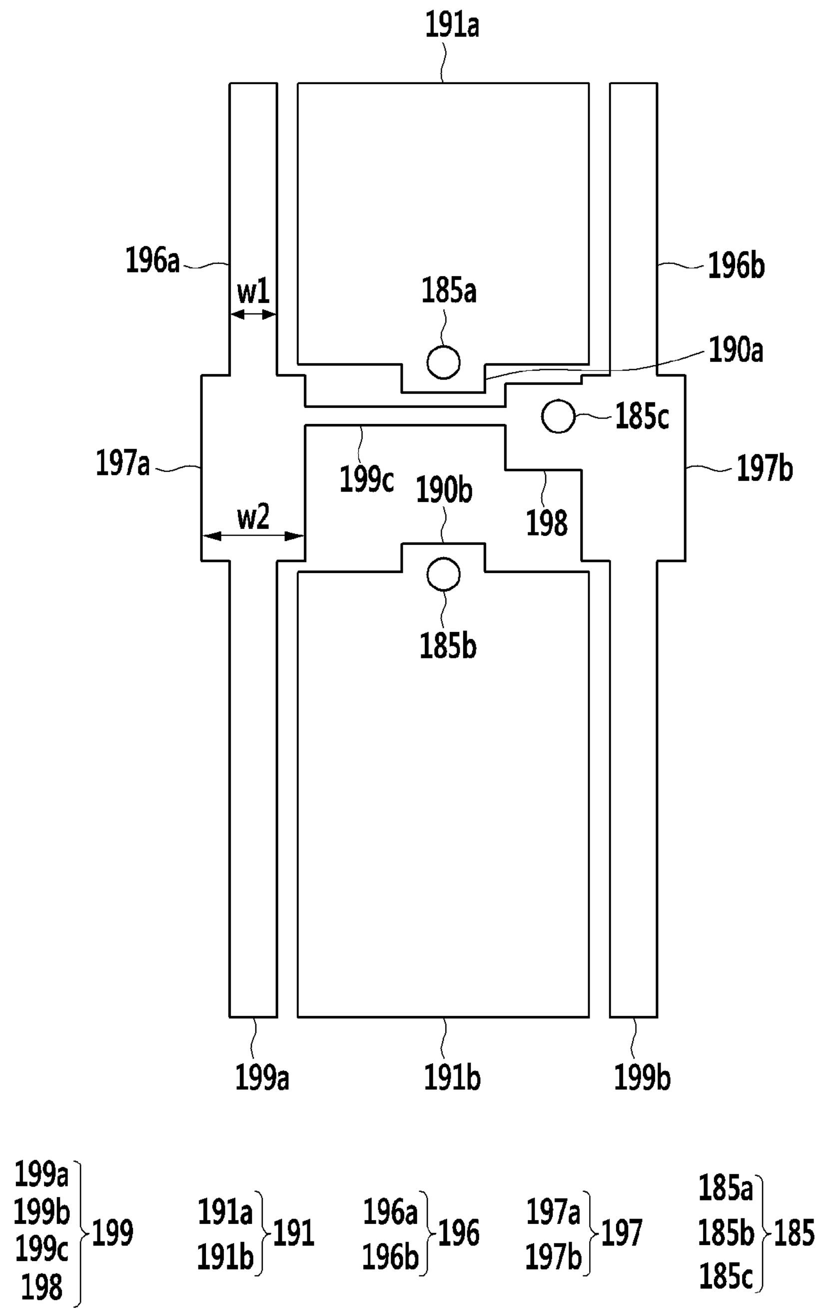


FIG. 3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199b
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185c
185

FIG. 4

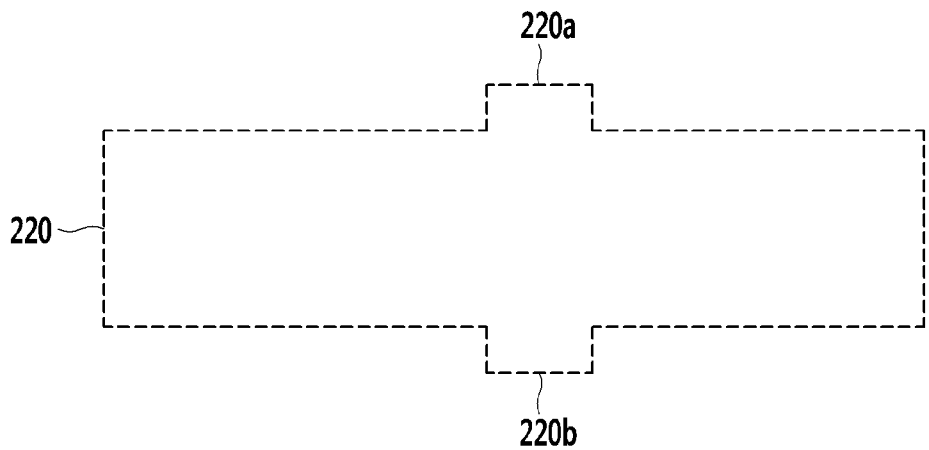
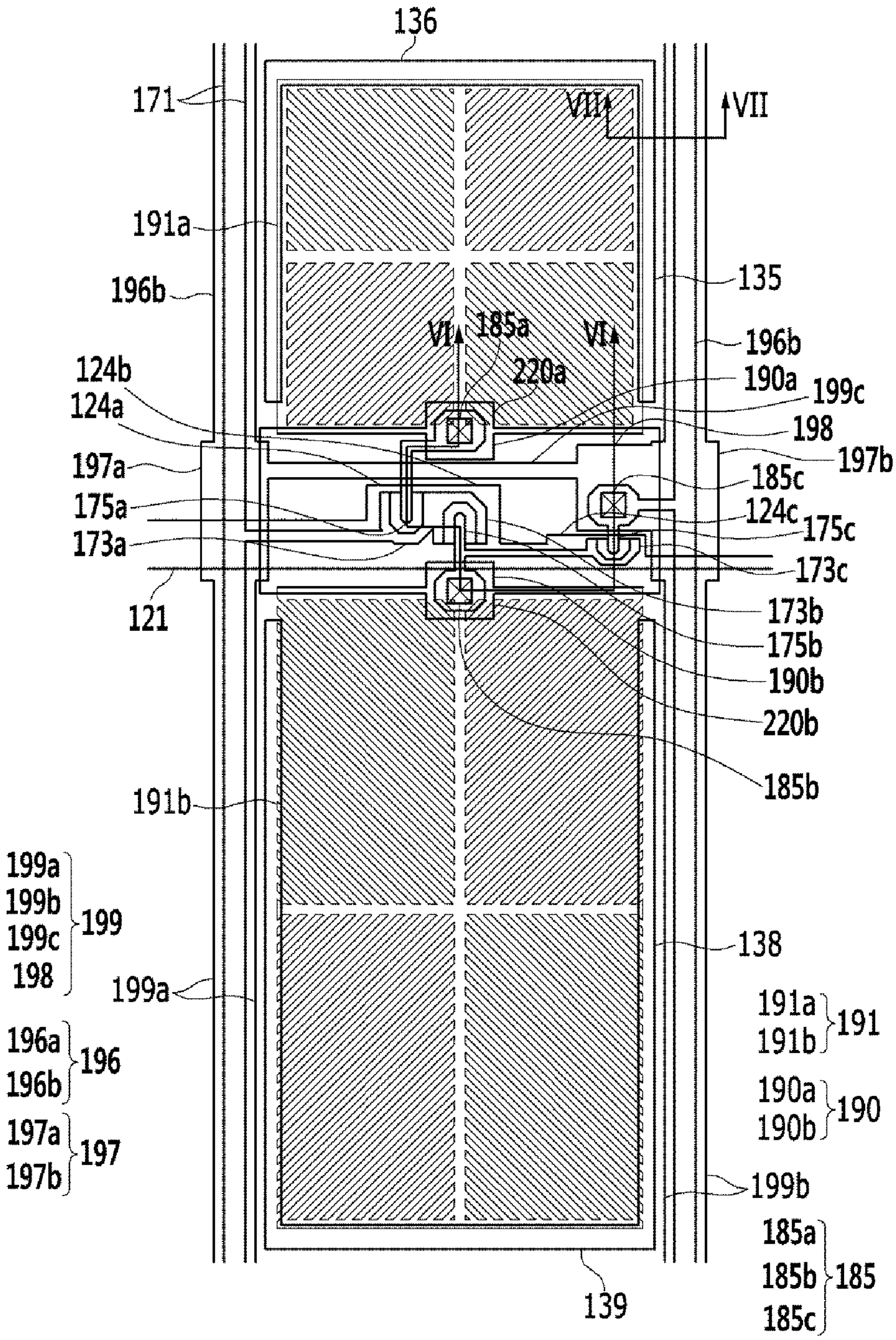


FIG. 5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197b
185c
175a
124c
175c
173a
173c
121
173b
175b
190b
220b
185b
191b
199a
199b
199c
198
199
138
199a
191a
191b
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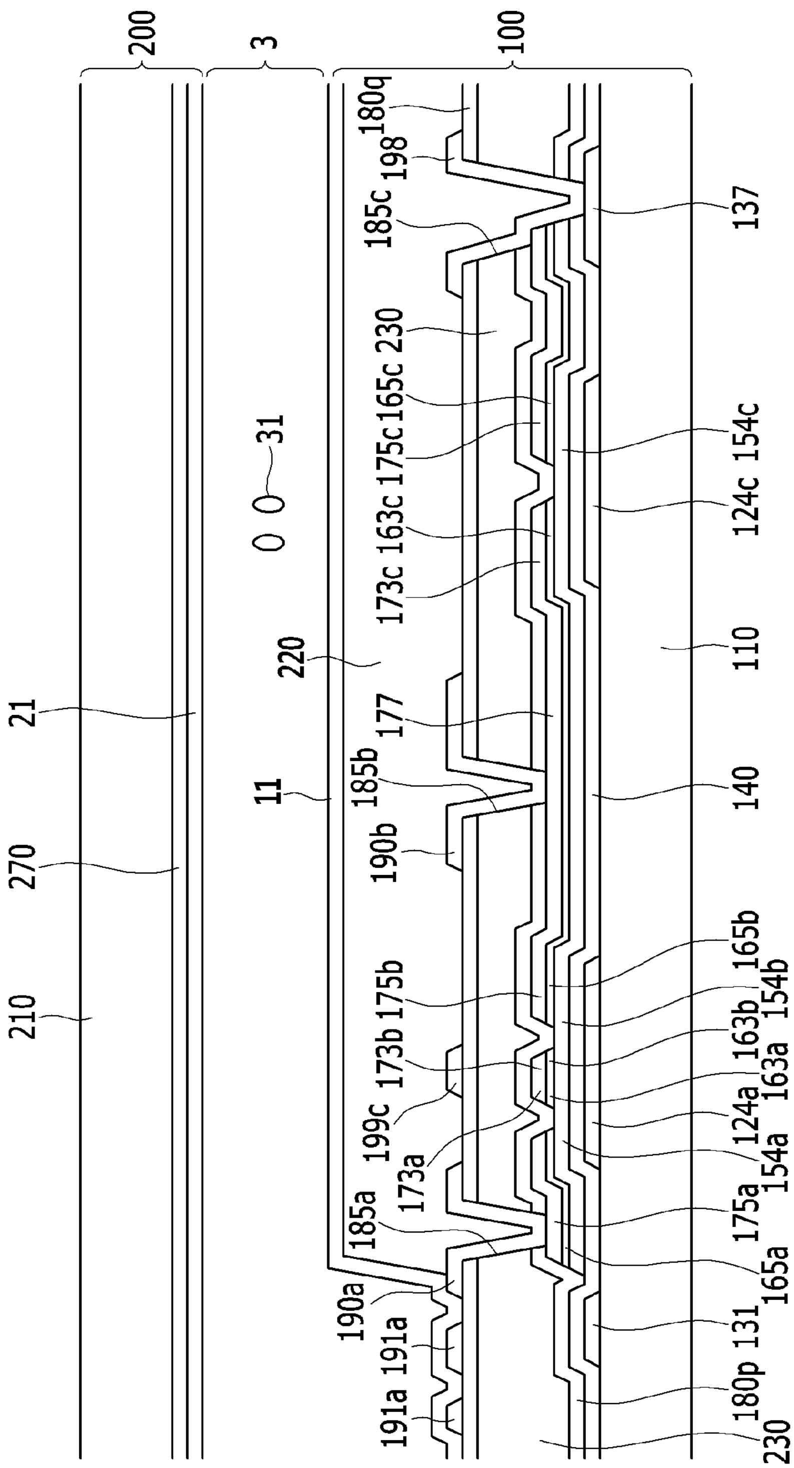
185c
185
139

FIG. 6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191a
137
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180p
230

FIG. 7

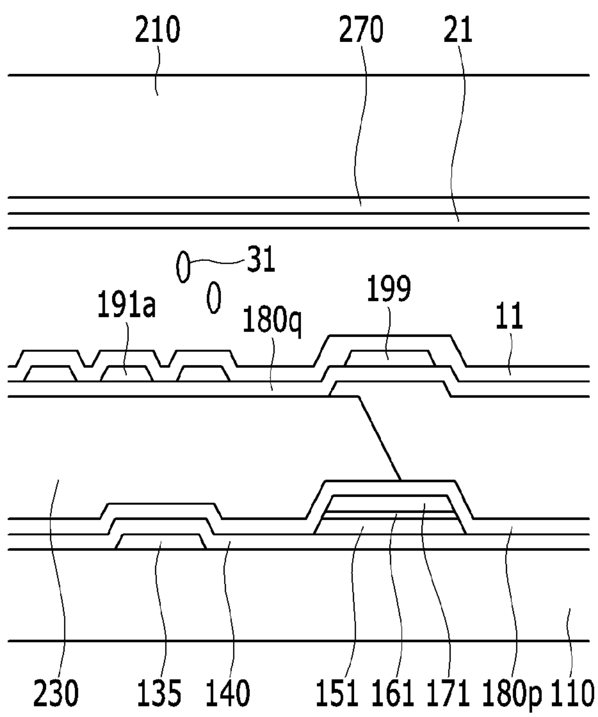
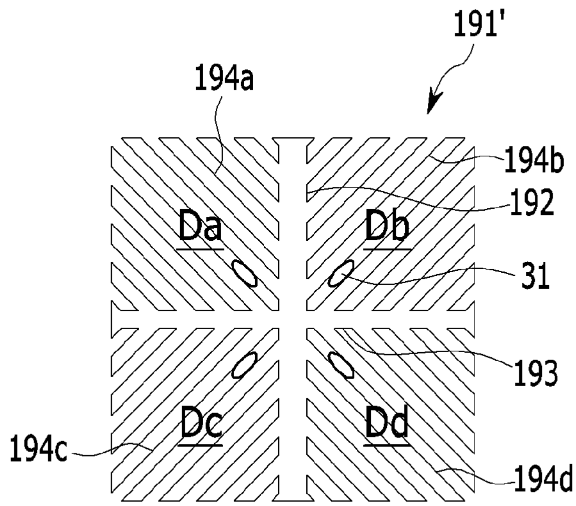


FIG. 8



LIQUID CRYSTAL DISPLAY

This application claims priority to Korean Patent Application No. 10-2015-0003672 filed on Jan. 9, 2015, and all the benefits accruing therefrom under 35 U.S.C. §119, the entire contents of which are incorporated herein by reference.

BACKGROUND

(a) Field

The invention relates to a liquid crystal display.

(b) Description of the Related Art

The liquid crystal display is one among flat panel displays which have been most widely used. The liquid crystal display includes two sheets of display panels in which a field generating electrode is disposed, and a liquid crystal layer interposed between the two sheets of display panels. In the liquid crystal display, the field generating electrode is applied with a voltage to generate an electric field in the liquid crystal layer. An orientation of liquid crystal molecules of the liquid crystal layer is determined by the electric field and polarization of incident light is controlled based on the generated electric field to display an image.

Among liquid crystal displays, a liquid crystal display which is widely used has a structure in which field generating electrodes such as a pixel electrode and a common electrode are provided in two separate display panels, respectively. Such a liquid crystal display has a structure in which a first display panel (hereinafter, referred to as 'thin film transistor array panel') among the two separate display panels includes therein a plurality of thin film transistors and pixel electrodes arranged in a matrix form and a second display panel (hereinafter, referred to as 'common electrode panel') among the two separate display panels includes therein red, green, and blue color filters, and the whole surface of the second display panel is covered with a common electrode.

In the above-described liquid crystal display, components thereof may be misaligned since accurately aligning the pixel electrode and the color filter which are disposed in different display panels may be difficult.

SUMMARY

In a liquid crystal display, a distance between the two display panels is referred to as a cell gap, and a liquid crystal layer is disposed in the cell gap. The cell gap affects operational characteristics of the liquid crystal display such as characteristics of a response speed, a contrast ratio, a viewing angle, luminance uniformity, and the like. When the cell gap is non-uniform, a uniform image is not displayed over an entirety of a screen of the liquid crystal display and thus image quality thereof may deteriorate. Therefore, to maintain a uniform cell gap over a entirety of the two display panels and the screen of the liquid crystal display, a spacer may be formed for one display panel among the two display panels. As the spacer, a column spacer ("CS") has been mainly used.

For simplification of a manufacturing process of a liquid crystal display, a light blocking member such as a black matrix and the spacer may be simultaneously formed. The light blocking member may be formed around a boundary between adjacent pixels in which color filters and signal lines such as data lines overlap each other. Such a light blocking member may be formed to extend further from a base substrate than a main column spacer portion of the spacer due to a stepped structure of underlying layers also disposed on the substrate. To solve this problem, an electrode of the respective display panel is disposed at an area where adjacent color filters overlap each other, but a light leakage problem occurs.

One or more exemplary embodiment of the invention provides a liquid crystal display having advantages of solving light leakage at a portion where color filters overlap each other.

An exemplary embodiment of the invention provides a liquid crystal display, including: a first display panel. The first display panel includes: a first insulating substrate; a gate line and a data line on the first insulating substrate, intersecting each other and being insulated from each other; a thin film transistor connected to the gate line and the data line; a pixel electrode connected to the thin film transistor, including a first sub-pixel electrode and a second sub-pixel electrode spaced apart from each other; a shielding electrode member on the data line, including a first shielding electrode and a second shielding electrode respectively at opposing sides of the pixel electrode, each of the first shielding electrode and the second shielding electrode including: an expanded part between the first sub-pixel electrode and the second sub-pixel electrode, and a vertical part elongated from the expanded part in a first direction parallel to the data line; and a light blocking member elongated in a second direction crossing the first direction to overlap the thin film transistor. A width in the second direction of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode is larger than that of the vertical part, and opposing edges of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode overlap the elongated light blocking member overlapping the thin film transistor.

At least one of the first sub-pixel electrode and the second sub-pixel electrode may include a protrusion protruding toward the gate line.

Both the first and second sub-pixel electrodes may include the protrusion, and the protrusion of the first sub-pixel electrode and the protrusion of the second sub-pixel electrode may face each other.

The shielding electrode member may further include an extension protruded in the second direction from one of the expanded parts between the first sub-pixel electrode and the second sub-pixel electrode.

The first display panel may further include a reference voltage line on the first insulating substrate; and a plurality of contact holes respectively exposing the thin film transistor and the reference voltage line. At least one protrusion of the pixel electrode and the extension of the shielding electrode member may overlap a contact hole among the plurality of contact holes.

The contact hole may overlap a portion of the pixel electrode except the at least one protrusion, and where the overlapped area of the contact hole and the portion of the pixel electrode may be less than about 50% of a planar area of the contact hole.

The shielding electrode member may further include a horizontal part elongated between the first sub-pixel electrode and the second sub-pixel electrode and may connect the first and second shielding electrodes to each other.

The extension of the shielding electrode member may protrude in the second direction from the expanded part of the second shielding electrode, and the horizontal part of the shielding electrode member may connect the expanded part of the first shielding electrode with the extension protruded from the expanded part of the second shielding electrode.

The light blocking member may extend along the gate line.

The light blocking member may include a cover part overlapping the protrusion of the at least one of the first sub-pixel electrode and the second sub-pixel electrode.

The liquid crystal display may further include color filters overlapping the pixel electrode, edges of which may overlap each other and the data line.

The shielding electrode member may overlap the overlapping edgesof the color filters.

The shielding electrode member and the pixel electrode may be in a same layer of the first display panel among layers on the first insulating substrate and include a same material.

The liquid crystal display may further include a second display panel facing the first display panel. The second display may may include: a second insulating substrate; a common electrode on the second insulating substrate; and a liquid crystal layer between the pixel electrode of the first display panel and the common electrode of the second display panel.

The shielding electrode member may be applied with the same voltage as that of the common electrode.

According to one or more exemplary embodiment of the liquid crystal display in accordance with the invention, a stepped structure and light leakage where signal lines (e.g., gate and/or data conductors) and color filters overlap each other are reduced or effectively prevented.

Further, the effects which may be obtained or predicted by the exemplary embodiment of the invention will be directly or implicitly disclosed in the detailed description of the exemplary embodiments of the invention. That is, various effects which are predicted by the exemplary embodiments of the invention will be disclosed in the detailed description to be described below.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other advantages and features of this disclosure will become more apparent by describing in further detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

FIG. **1** is a plan view of an exemplary embodiment of a liquid crystal display according to the invention.

FIG. **2** is a cross-sectional view taken along line II-II of FIG. **1**.

FIG. **3** is a plan view illustrating an exemplary embodiment of a pixel electrode and a shielding electrode in the liquid crystal display of FIG. **1**.

FIG. **4** is a plan view illustrating an exemplary embodiment of a light blocking member in the liquid crystal display of FIG. **1**.

FIG. **5** is a plan view illustrating an exemplary embodiment of a structure within the liquid crystal display of FIG. **1**.

FIG. **6** is a cross-sectional view taken along line VI-VI of FIG. **5**.

FIG. **7** is a cross-sectional view taken along line VII-VII of FIG. **5**.

FIG. **8** is a plan view illustrating an exemplary embodiment of a basic region of a pixel electrode of a liquid crystal display according to the invention.

DETAILED DESCRIPTION

Hereinafter, exemplary embodiments of the invention will be described in detail with reference to the accompanying drawings. However, the invention is not limited to the exemplary embodiments set forth herein but may be modified in many different forms. On the contrary, exemplary embodiments introduced herein are provided to make disclosed contents thorough and complete and sufficiently transfer the spirit of the invention to those skilled in the art.

In the drawings, the thickness of layers, films, panels, regions, etc., are exaggerated for clarity. Further, it will be understood that when a layer is referred to as being "on" another layer or substrate, it can be directly on the other layer or substrate, or intervening them may also be present. Like reference numerals designate like elements throughout the specification.

It will be understood that, although the terms "first," "second," "third" etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, "a first element," "component," "region," "layer" or "section" discussed below could be termed a second element, component, region, layer or section without departing from the teachings herein.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms, including "at least one," unless the content clearly indicates otherwise. "Or" means "and/or." As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. It will be further understood that the terms "comprises" and/or "comprising," or "includes" and/or "including" when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

Furthermore, relative terms, such as "lower" or "bottom" and "upper" or "top," may be used herein to describe one element's relationship to another element as illustrated in the Figures. It will be understood that relative terms are intended to encompass different orientations of the device in addition to the orientation depicted in the Figures. For example, if the device in one of the figures is turned over, elements described as being on the "lower" side of other elements would then be oriented on "upper" sides of the other elements. The exemplary term "lower," can therefore, encompasses both an orientation of "lower" and "upper," depending on the particular orientation of the figure. Similarly, if the device in one of the figures is turned over, elements described as "below" or "beneath" other elements would then be oriented "above" the other elements. The exemplary terms "below" or "beneath" can, therefore, encompass both an orientation of above and below.

"About" or "approximately" as used herein is inclusive of the stated value and means within an acceptable range of deviation for the particular value as determined by one of ordinary skill in the art, considering the measurement in question and the error associated with measurement of the particular quantity (i.e., the limitations of the measurement system). For example, "about" can mean within one or more standard deviations, or within ±30%, 20%, 10%, 5% of the stated value.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

Exemplary embodiments are described herein with reference to cross section illustrations that are schematic illustrations of idealized embodiments. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments described herein should not be construed as limited to the particular shapes of regions as illustrated herein but are to include deviations in shapes that result, for example, from manufacturing. For example, a region illustrated or described as flat may, typically, have rough and/or nonlinear features. Moreover, sharp angles that are illustrated may be rounded. Thus, the regions illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the precise shape of a region and are not intended to limit the scope of the present claims.

Hereinafter, exemplary embodiments of the invention will be described in detail with reference to the accompanying drawings.

FIG. **1** is a plan view of an exemplary embodiment of a liquid crystal display according to the invention and FIG. **2** is a cross-sectional view taken along line II-II of FIG. **1**.

Referring to FIGS. **1** and **2**, a film structure **120** including a gate line **121** and a data line **171** is positioned on a lower substrate **110**.

As illustrated in FIG. **1**, the gate line **121** is elongated to mainly extend in a horizontal direction and transfers a gate signal.

As illustrated in FIG. **1**, the data line **171** is elongated to mainly extend in a vertical direction and transfers a data signal. The data line **171** intersects the gate line **121**.

Further, the film structure **120** includes a thin film transistor. The thin film transistor is a switching element. The switching element may include three terminals such as a control terminal, an input terminal and an output terminal, which will be described below in detail.

A plurality of color filters **230** are positioned on the film structure **120**. The plurality of color filters **230** includes a red color filter (R), a green color filter (G) and a blue color filter (B). For convenience of explanation, a red color filter, a green color filter and a blue color filter only are illustrated herein, but a color filter **230** representing other colors may be further provided.

Further, the plurality of color filters **230** may each be elongated in the vertical direction to be formed in a striped-shape. The plurality of color filters **230** may be arranged in the horizontal direction and be disposed parallel to each other. Opposing edges of a color filter are disposed to overlap color filters adjacent thereto.

A pixel electrode **191** and a shielding electrode **199** are positioned on the plurality of color filters **230**.

The pixel electrode **191** includes a first sub-pixel electrode **191***a* and a second sub-pixel electrode **191***b*. The first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* are disposed to be spaced apart from each other such as at a constant interval. That is, the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* may be disposed to be spaced apart from each at opposing sides of the gate **121**.

As illustrated in FIG. **3**, the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* are each provided with protrusions **190** extended from main portions thereof. That is, the first sub-pixel electrode **191***a* is provided with a first protrusion **190***a* extended from a main portion thereof and the second sub-pixel electrode **191***b* is provided with a second protrusion **190***b* extended from a main portion thereof. The first protrusion **190***a* and the second protrusion **190***b* are respectively extended to protrude from the main portions of the pixel electrode **191** and toward the gate line **121**. The first protrusion **190***a* and the second protrusion **190***b* may be disposed to face each other.

The shielding electrode **199** is positioned on the color filter **230**. That is, the shielding electrode **199** may be positioned at a portion where the color filters **230** overlap each other. As illustrated in FIG. **3**, the shielding electrode **199** includes a first shielding electrode **199***a*, a second shielding electrode **199***b*, an extension **198** and a horizontal part **199***c*. The first shielding electrode **199***a* and the second shielding electrode **199***b* may be disposed at opposing sides of the pixel electrode **191**.

The shielding electrode **199** collectively includes the first shielding electrode **199***a*, the second shielding electrode **199***b*, the extension **198** and the horizontal part **199***c* which are not separately disposed from each other (e.g., are continuously extended from each other) and connected to form a single, unitary, indivisible member. Further, the shielding electrodes **199** of adjacent pixels may also be connected to each other so as to form a single, unitary, indivisible member across the adjacent pixels.

As illustrated in FIG. **3**, the first shielding electrode **199***a* and the second shielding electrode **199***b* each include a vertical part **196** and an expanded part **197**. The vertical part **196** is elongated in an extension direction parallel to that of the data line **171**. The vertical part **196** may have a shape similar to a plane shape of the data line **171**. That is, the plane shape of the vertical part **196** may have a rectangular shape in the plan view. The vertical part **196** may include the first vertical part **196***a* which is a portion of the first shielding electrode **199***a* and a second vertical part **196***b* which is a portion of the second shielding electrode **199***b*.

The expanded part **197** is connected to the vertical part **196** and includes a first expanded part **197***a* which is a portion of the first shielding electrode **199***a* and a second expanded part **197***b* which a portion of the second shielding electrode **199***b*. The first expanded part **197***a* and the second expanded part **197***b* are positioned between the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* adjacent in the vertical direction. The first and second vertical parts **196***a* and **196***b* may collectively include portions respectively extending from opposing edges of the first and second expanded parts **197***a* and **197***b*.

As represented by the first expanded part **197***a* illustrated in FIG. **2**, opposing edges of the expanded part **197** may be positioned under a light blocking member **220**. A width of the vertical part **196** and the expanded part **197** is taken perpendicular to an extension direction thereof. As illustrated in FIG. **3**, a width w**2** of the expanded part **197** may be larger than a width w**1** of the vertical part **196**. As such, the shielding electrode **199** and the light blocking member **220** overlap each other and therefore the light leakage may be blocked.

The extension **198** of the shielding electrode **199** may be connected to the expanded part **197**. That is, as illustrated in FIGS. **1** and **3**, the extension **198** may be connected to the second expanded part **197***b*.

The protrusions **190** of the pixel electrode **191** and the extension **198** of the shielding electrode **199** may each overlap with a contact hole **185**. That is, a first contact hole **185***a* may overlap the first protrusion **190***a*, a second contact hole **185***b* may overlap the second protrusion **190***b*, and a third contact hole **185***c* may overlap the extension **198**.

The first contact hole **185***a* and the second contact hole **185***b* may be respectively also disposed to overlap a portion of the first sub-pixel electrode **191***a* except the first protrusion **190***a* and a portion of the second sub-pixel electrode **191***b* except the second protrusion **190***b*. The overlapped area of the first contact hole **185***a* and the portion of the first sub-pixel electrode **191***a* may be less than about 50% of a total planar area of the first contact hole **185***a* to reduce or effectively prevent a reduction in transmittance. Similarly, the overlapped area of the second contact hole **185***b* and the portion of the second sub-pixel electrode **191***b* may be less than about 50% of a total planar area of the second contact hole **185***b*.

The horizontal part **199***c* of the collective shielding electrode **199** connects the first shielding electrode **199***a* to the second shielding electrode **199***b*. That is, the horizontal part **199***c* may be connected to the first expanded part **197***a* and the extension **198** to connect the first shielding electrode **199***a* and the second shielding electrode **199***b* to each other. The horizontal part **199***c* may be positioned on the gate line **121** and may be positioned between the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b*, in the plan view.

The light blocking member **220** is elongated in the horizontal direction to be positioned on the plurality of color filters **230** adjacent to each other in the horizontal direction. As illustrated in FIG. **1**, the light blocking member **220** is elongated to extend along the gate line **121**.

Further, as illustrated in FIGS. **1** and **4**, the light blocking member **220** includes cover parts **220***a* and **220***b* extending from a main portion thereof. The cover parts **220***a* and **220***b* may be disposed a position corresponding to the protrusion **190** of the pixel electrode **191**. The cover parts **220***a* and **220***b* may be elongated from the main portion of the light blocking member **220** to protrude toward the pixel electrode **191**.

The first cover part **220***a* of the light blocking member **220** may be disposed at a position corresponding to the first protrusion **190***a* of the first sub-pixel electrode **191***a* and the second cover part **220***b* of the light blocking member **220** may be disposed at a position corresponding to the second protrusion **190***b* of the second sub-pixel electrode **191***b*. The first cover part **220***a* and the second cover part **220***b* are disposed to cover the contact hole **185** which is overlapped with the first protrusion **190***a* and the second protrusion **190***b*. As described with reference to FIGS. **1** to **4**, according to one or more exemplary embodiment of the invention, the width of the expanded part **197** of the shielding electrode **199** is wider than that of the vertical part **196** of the shielding electrode **199** and thus the shielding electrode **199** and the light blocking member **220** overlap each other at the area where adjacent color filters overlap each other, thereby preventing the light leakage at an area where adjacent color filters overlap each other.

Hereinafter, the liquid crystal display embodying the exemplary embodiment of FIG. **1** will be described with reference to FIGS. **5** to **7**.

FIG. **5** is a plan view illustrating an exemplary embodiment of a structure within the liquid crystal display of FIG. **1**, FIG. **6** is a cross-sectional view taken along line VI-VI of FIG. **5**, and FIG. **7** is a cross-sectional view taken along line VII-VII of FIG. **5**.

Referring to FIGS. **5** and **7**, the liquid crystal display includes a lower display panel **100** and an upper display panel **200** facing each other, a liquid crystal layer **3** including a liquid crystal molecule **31** interposed between the two display panels **100** and **200**. A pair of polarizers (not illustrated) may be attached outer surfaces of the display panels **100** and **200**.

First, the lower display panel **100** will be described.

A gate conductor which includes the gate line **121** and a reference voltage line **131** is disposed on a first insulating (e.g., lower) substrate **110** including transparent glass, plastic, or the like. A distal or terminal end of the gate line **121** includes a relatively wide end (not illustrated) so as to be connected to other layers or external driving circuits. The gate line **121** includes therein a first gate electrode **124***a*, a second gate electrode **124***b* and a third gate electrode **124***c*. The reference voltage line **131** includes first storage electrodes **135** and **136** and a reference electrode **137**. Second storage electrodes **138** and **139**, which are not connected to the reference voltage line **131** but overlap a second sub-pixel electrode **191***b*, are also disposed on the first insulating substrate **110**.

A gate insulating layer **140** is positioned on the gate line **121** and the reference voltage line **131** of the gate conductor. A first semiconductor layer **154***a*, a second semiconductor layer **154***b* and a third semiconductor layer **154***c* are positioned on the gate insulating layer **140**. A plurality of ohmic contacts **163***a*, **165***a*, **163***b*, **165***b*, **163***c* and **165***c* is disposed on the semiconductor layers **154***a*, **154***b* and **154***c*.

A data conductor including a plurality of data lines **171** including a first source electrode **173***a* and a second source electrode **173***b*, a first drain electrode **175***a*, a second drain electrode **175***b*, a third source electrode **173***c* and a third drain electrode **175***c* is positioned on the ohmic contacts **163***a*, **165***a*, **163***b*, **165***b*, **163***c* and **165***c* and the gate insulating layer **140**. In an exemplary embodiment of manufacturing a display device, the data conductor, the semiconductor positioned therebeneath, and the ohmic contact may be simultaneously formed using a single mask such that planar shapes of these elements correspond to each other.

The data line **171** may include at a distal or terminal end thereof, a relatively wide tip portion (not illustrated) for connecting to another layer or an external driving circuit, a semiconductor layer **151** and an ohmic contact **161** in the same plane form. The first gate electrode **124***a*, the first source electrode **173***a* and the first drain electrode **175***a* forms a first thin film transistor together with the first (island-type) semiconductor layer **154***a* and a channel of a first thin film transistor is formed by a portion of the first semiconductor layer **154***a* exposed between the first source electrode **173***a* and the first drain electrode **175***a*. Similarly, the second gate electrode **124***b*, the second source electrode **173***b* and the second drain electrode **175***b* form a second thin film transistor together with a second (island-type) semiconductor layer **154***b* and a channel of the second thin film transistor is formed by a portion of the second semiconductor layer **154***b* exposed between the second source electrode **173***b* and the second drain electrode **175***b*. The third gate electrode **124***c*, the third source electrode **173***c* and the third drain electrode **175***c* form a third thin film transistor together with the third (island-type) semiconductor layer **154***c* and a channel of the third thin film transistor is formed by a portion of the third semiconductor layer **154***c* exposed between the third source electrode **173***c* and the third drain electrode **175***c*. The second drain electrode **175***b* is connected to the third source electrode **173***c* and includes an expansion **177** which has a relatively wide planar area compared to a remaining portion of the second drain electrode **175***b*.

A first passivation layer **180***p* is positioned on the data conductor **171**, **173***a*, **173***b*, **173***c*, **175***a*, **175***b* and **175***c* and the exposed semiconductors layers **154***a*, **154***b* and **154***c* respectively disposed between data conductor portions. The first passivation layer **180***p* may be an inorganic insulting layer including silicon nitride, silicon oxide, or the like. The first passivation layer **180***p* may reduce or effectively prevent a pigment of a color filter **230** from flowing in the exposed semiconductor layers **154***a*, **154***b* and **154***c*.

The plurality of color filters **230** is disposed on the first passivation layer **180***p*. The color filter **230** may include organic insulating material.

The plurality of color filters **230** may be arranged in a horizontal direction and parallel to each other, and may be disposed to overlap each other in the horizontal direction by a predetermined interval or overlapping area.

The color filter **230** may uniquely display one among primary colors. An example of the primary colors may include the three primary colors, such as red, green and blue, or yellow, cyan magenta, and the like. In an exemplary embodiment, the color filter **230** may display a mixed color of the primary colors or a white color, in addition to the primary colors.

A second passivation layer **180***q* is positioned on the color filter **230**. The second passivation layer **180***q* may be an inorganic insulting layer including silicon nitride, silicon oxide, or the like. The second passivation layer **180***q* reduces of effectively prevents the color filter **230** from lifting and suppresses the pollution of the liquid crystal layer **3** due to organic materials, such as a solvent inflowing from the color filter **230**. The second passivation layer **180***q* thereby reduces or effectively prevents defects, such as an afterimage which may occur at the time of driving the screen, from occurring, due to such lifting and/or solvent inflow.

The first contact hole **185***a* and the second contact hole **185***b* exposing the first drain electrode **175***a* and the second drain electrode **175***b* are defined in each of the first passivation layer **180***p*, the color filter **230** and the second passivation layer **180***q*. A third contact hole **185***c* exposing both of the reference electrode **137** and the third drain electrode **175***c* is defined in the first passivation layer **180***p*, the second passivation layer **180***q* and the gate insulating layer **140**. The reference electrode **137** and the third drain electrode **175***c* which are exposed through the third contact hole **185***c* are electrically connected to each other at the third contact hole **185***c*. The first contact hole **185***a* may be disposed overlapping the first protrusion **190***a* of the pixel electrode **191**, the second contact hole **185***b* may be disposed overlapping the second protrusion **190***b* of the pixel electrode **191**, and the third contact hole **185***c* may be disposed overlapping the extension **198** of the shielding electrode **199**.

A plurality of pixel electrodes **191** are disposed on the second passivation layer **180***q*. Each of the pixel electrodes **191** may include first and second sub-pixel electrodes **191***a* and **191***b* adjacent to each other in a column (e.g., vertical) direction and separated from each other, having the gate line **121** disposed therebetween. The pixel electrode **191** may include a transparent conductive material such as indium tin oxide ("ITO") and indium zinc oxide ("IZO") or may also include a reflective metal such as aluminum, silver, chromium, or an alloy thereof.

Each of the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* each include a basic electrode **191'** in illustrated in FIG. **8** or at least one modification thereof.

The first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* are physically and electrically connected to the first drain electrode **175***a* and the second drain electrode **175***b*, respectively, through the first and second contact holes **185***a* and **186***b* and are applied with a data voltage from the first drain electrode **175***a* and the second drain electrode **175***b*. Some of the data voltage applied to the second drain electrode **175***b* is divided by the third source electrode **173***c*, such that a magnitude of the voltage applied to the first sub-pixel electrode **191***a* is larger than that of the voltage applied to the second sub-pixel electrode **191***b*.

Each of the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* include a protrusion protruding from a main portion thereof and toward the gate line **121**. The protrusion **190** of the pixel electrode **191** may be positioned under the light blocking member **220** in a cross-sectional thickness direction. The first sub-pixel electrode **191***a* is provided with the first protrusion **190***a* and the second sub-pixel electrode **191***b* is provided with the second protrusion **190***b*. The first protrusion **190***a* and the second protrusion **190***b* may be positioned in an area between main portions of the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b*. The first protrusion **190***a* may overlap with the first contact hole **185***a* and the second protrusion **190***b* may overlap with the second contact hole **185***b*. Due to the expanded part **197** of the shielding electrode **199** being widened near an area of the thin film transistor, an area in which to dispose the thin film transistor may be reduced. Since the area in which to dispose the thin film transistor is reduced, the contact hole **185** is disposed overlapping the protrusion **190** of the pixel electrode **191** to provide a space for the thin film transistor.

The first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* to which the data voltage is applied generate an electric field, along with a common electrode **270** of the upper display panel **200** to be described below, thereby determining an orientation of liquid crystal molecules **31** of the liquid crystal layer **3** between the two electrodes **191** and **270**. The luminance of light passing through the liquid crystal layer **3** along the orientation of the liquid crystal molecules determined as described above is changed.

The shielding electrode **199** may be positioned in the same layer as pixel electrode **191** among layers of the lower display panel **100** disposed on the first insulating (e.g., lower) substrate **110**.

The shielding electrode **199** may be positioned to overlap the data line **171** and may be positioned on a portion where the color filters **230** overlap each other. The shielding electrode **199** may have the same or similar plane shape of the data line **171** in the plan view. The collective shielding electrode **199** includes the first shielding electrode **199***a* and the second shielding electrode **199***b* which are positioned at opposing sides of the pixel electrode **191**. The collective shielding electrode **199** further includes the horizontal part **199***c* which connects the first shielding electrode **199***a* and the second shielding electrode **199***b* to each other, such as being connected to the extension **198** of the second shielding electrode **199***b*. The collective shielding electrode **199** includes the first shielding electrode **199***a*, the second shielding electrode **199***b*, the extension **198** and the horizontal part **199***c* which are not separately formed from each other to form a single, unitary indivisible member.

The first shielding electrode **199***a* and the second shielding electrode **199***b* each include the vertical part **196** and the expanded part **197**. The vertical part **196** is elongated to extend parallel with the data line **171**, and the expanded part **197** is connected to the vertical part **196**. Referring to FIG. **2**, opposing edges of the expanded part **197** may be positioned under the light blocking member **220** in the cross-sectional thickness direction. The expanded part **197** may be positioned in an area between the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* adjacent to each other in the column (e.g., vertical) direction in the plan view. The width w**2** of the expanded part **197** may be larger than the width w**1** of the vertical part **196**.

The first shielding electrode **199***a* includes the first vertical part **196***a* and the first expanded part **197***a* and the second shielding electrode **199***b* includes the second vertical part **196***b* and the second expanded part **197***b*. The extension **198** may further extend from the second expanded part **197** of the second shielding electrode **199***b*. The extension **198** may overlap the third contact hole **185***c*.

The horizontal part **199***c* of the shielding electrode **199** is elongated to extend parallel with the gate line **121** and is positioned in the space between the first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* adjacent to each other in the column (e.g., vertical) direction. The horizontal part **199***c* connects the extension **198** of the second shielding electrode **199***b* and the expanded part **197***a* of the first shielding electrode **199***a* to each other.

The electric field between the pixel and common electrodes **191** and **270** may be stabilized with the above-described structure of the shielding electrode **199** and the common electrode **270** and thus the liquid crystal may be controlled.

The shielding electrode **199** may include transparent conductive material, such as ITO and IZO, or a reflective metal such as aluminum, silver, chromium, or an alloy thereof. That is, the shielding electrode **199** may include a same material as the pixel electrode **191** or may include different materials from the pixel electrode **191**. In an exemplary embodiment of manufacturing a display device, the shielding electrode **199** and the pixel electrode **191** may be simultaneously formed such as using the same mask, to dispose the shielding electrode **199** and the pixel electrode **191** in a same layer among layers of the lower display panel **100** disposed on the first insulating (e.g., lower) substrate **110**.

The shielding electrode **199** is applied with the same voltage as the common electrode **270**, and therefore the electric field is not generated between the shielding electrode **199** and the common electrode **270**. Since the electric field is not generated between the shielding electrode **199** and the common electrode **270**, liquid crystal molecules **31** are not oriented between the shielding electrode **199** and the common electrode **270** are not oriented. Therefore, the liquid crystal molecules **31** which are positioned as described above define a black state of the liquid crystal display, and thus may serve as the light blocking member **220**.

Therefore, in one or more exemplary embodiment of the liquid crystal display according to the invention, the shielding electrode **199** may provide a light shielding function in addition to the light blocking member **220** providing a light shielding function.

The light blocking member **220** is positioned on the second passivation layer **180***q* and the pixel electrode **191**. The light blocking member **220** is elongated to extend parallel with the gate line **121** and is disposed to cover the gate line **121** and the thin film transistor at a pixel non-display area.

Further, the light blocking member **220** includes cover parts **220***a* and **220***b* to cover the contact hole **185** which overlaps the protrusion **190** of the pixel electrode **191**. That is, the light blocking member **220** includes the first cover part **220***a* to cover the first protrusion **190***a* of the first pixel electrode **191***a* and includes the second cover part **220***b* to cover the second protrusion **190***b* of the second pixel electrode **191***b*.

Although not illustrated herein, a spacer may be positioned on the light blocking member **220**. The spacer may include a main column spacer and a sub-column spacer which have different steps from each other. The main column spacer serves to support the space between the upper display panel **200** and the lower display panel **100** and the sub-column spacer serves to assist a role of the main column spacer by supporting the space between the upper display panel **200** and the lower display panel **100**.

A lower alignment layer **11** is positioned on the pixel electrode **191** and the light blocking member **220**.

Hereinafter, the upper display panel **200** will be described.

The common electrode **270** is disposed on a second insulating substrate **210**. The common electrode **270** may include a transparent conductor material, such as ITO and IZO.

An upper alignment layer **21** is disposed on the common electrode **270**.

The liquid crystal layer **3** includes the plurality of liquid crystal molecules **31**. The liquid crystal molecules **31** are aligned to be perpendicular to the surfaces of the two substrates **110** and **210** and are oriented to have a pretilt inclined in the same direction as a length direction of a slotted pattern of the pixel electrode **191**, in the state in which a voltage is not applied to the two field generating electrodes **191** and **270**.

Hereinafter, the basic electrode of the pixel electrode will be described with reference to FIG. **8**.

FIG. **8** is a plan view illustrating an exemplary embodiment of a basic region of a pixel electrode of a liquid crystal display according to the invention.

Referring to FIG. **8**, the overall shape of the basic electrode **191'** is a quadrangle and includes a stem part which is configured of a horizontal stem part **193** and a vertical stem part **192** orthogonal thereto. Further, the basic electrode **191'** is divided into a first subregion Da, a second subregion Db, a third subregion Dc and a fourth subregion Dd by the horizontal stem part **193** and the vertical stem part **192**. The first to fourth subregions Da to Dd respectively include a plurality of first fine branch parts **194***a*, a plurality of second fine branch parts **194***b*, a plurality of third fine branch parts **194***c* and a plurality of fourth fine branch parts **194***d*.

The first fine branch parts **194***a* obliquely extend in an upper-left extension direction from the horizontal stem part **193** or the vertical stem part **192**, and the second fine branch parts **194***b* obliquely extend in an upper-right extension direction from the horizontal stem part **193** or the vertical stem part **192**. The third fine branch parts **194***c* extend in a lower-left extension direction from the horizontal stem part **193** or the vertical stem part **192**, and the fourth fine branch parts **194***d* obliquely extend in a lower-right extension direction from the horizontal stem part **193** or the vertical stem part **192**.

The first to fourth fine branch parts **194***a*, **194***b*, **194***c* and **194***d* respectively form an angle of approximately 45° or approximately 135° with respect to the gate line **121** or the horizontal stem part **193**. Further, extension directions of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d* of two neighboring subregions among subregions Da, Db, Dc and Db may be orthogonal to each other.

Widths of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d* are taken perpendicular to extension directions thereof. Widths of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d* may range from about 2.5 micrometers (μm) to about 5.0 μm. A respective width-direction interval between the adjacent fine branch parts **194***a*, **194***b*, **194***c* and **194***d* within one sub-pixel region Da, Db, Dc and Dd may range from about 2.5 μm to about 5.0 μm.

According to another exemplary embodiment of the invention, the widths of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d* may increase along the extension directions thereof toward the horizontal stem part **193** or the vertical stem part **192**. A difference between the widest width and the narrowest width within one of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d* may range from about 0.2 μm to about 1.5 μm.

The first sub-pixel electrode **191***a* and the second sub-pixel electrode **191***b* are connected to the first drain electrode **175***a* and the second drain electrode **175***b*, respectively, through the first and second contact holes **185***a* and **186***b*, and are applied with a data voltage from the first drain electrode **175***a* and the second drain electrode **175***b*. Sides of the first to fourth fine branch parts **194***a*, **194***b*, **194***c* and **194***d* distort an electric field to generate a horizontal component which determines an inclined direction of the liquid crystal molecules **31**. The horizontal component of the electric field is substantially parallel to the sides of the first to fourth fine branch parts **194***a*, **194***b*, **194***c* and **194***d*.

Therefore, as illustrated in FIG. **8**, the liquid crystal molecules **31** are respectively inclined in a direction parallel with a length (e.g., extension) direction of the fine branch parts **194***a*, **194***b*, **194***c* and **194***d*. A single one basic pixel electrode **191'** includes the four subpixel regions Da, Db, Dc and Dd in which the length directions of the fine branches **194***a*, **194***b*, **194***c* and **194***d* are different from each other. With the length directions of the fine branches **194***a*, **194***b*, **194***c* and **194***d* are different from each other the direction in which the liquid crystal molecules **31** are inclined is approximately four directions such that the liquid crystal layer **3** is formed with four domains in which the alignment directions of the liquid crystal molecules **31** are different. As such, when the direction in which the liquid crystal molecules **31** are inclined is various, a reference viewing angle of the liquid crystal display is increased.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. A liquid crystal display, comprising:
a first display panel comprising:
a first insulating substrate;
a gate line and a data line on the first insulating substrate, intersecting each other and being insulated from each other;
a thin film transistor connected to the gate line and the data line;
a pixel electrode connected to the thin film transistor, including a first sub-pixel electrode and a second sub-pixel electrode spaced apart from each other;
a shielding electrode member on the data line, including a first shielding electrode and a second shielding electrode respectively at opposing sides of the pixel electrode, each of the first shielding electrode and the second shielding electrode including:
an expanded part between the first sub-pixel electrode and the second sub-pixel electrode, and
a vertical part elongated from the expanded part in a first direction parallel to the data line; and
a light blocking member elongated in a second direction crossing the first direction to overlap the thin film transistor,
wherein
a width in the second direction of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode is larger than that of the vertical part, and
opposing edges of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode overlap the elongated light blocking member overlapping the thin film transistor.

2. The liquid crystal display of claim **1**, wherein:
at least one of the first sub-pixel electrode and the second sub-pixel electrode includes a protrusion protruding toward the gate line.

3. The liquid crystal display of claim **2**, wherein:
both the first and second sub-pixel electrodes include the protrusion, and the protrusion of the first sub-pixel electrode and the protrusion of the second sub-pixel electrode face each other.

4. The liquid crystal display of claim **2**, wherein:
the shielding electrode member further includes an extension protruded in the second direction from one of the expanded parts between the first sub-pixel electrode and the second sub-pixel electrode.

5. The liquid crystal display of claim **4**, further comprising:
a reference voltage line on the first insulating substrate; and
a plurality of contact holes respectively exposing the thin film transistor and the reference voltage line,
wherein:
at least one protrusion of the pixel electrode and the extension of the shielding electrode member overlaps a contact hole among the plurality of contact holes.

6. The liquid crystal display of claim **5**, wherein:
the contact hole overlaps a portion of the pixel electrode except the at least one protrusion, and where the overlapped area of the contact hole and the portion of the pixel electrode is less than about 50% of a planar area of the contact hole.

7. The liquid crystal display of claim **4**, wherein:
the shielding electrode member further includes a horizontal part elongated between the first and second sub-pixel electrodes, the horizontal part connecting the first and second shielding electrodes to each other.

8. The liquid crystal display of claim **7**, wherein:
the extension of the shielding electrode member protrudes in the second direction from the expanded part of the second shielding electrode, and
the horizontal part of the shielding electrode member connects the expanded part of the first shielding electrode with the extension protruded from the expanded part of the second shielding electrode.

9. The liquid crystal display of claim **2**, wherein:
the light blocking member extends along the gate line.

10. The liquid crystal display of claim **9**, wherein:
the light blocking member includes a cover part which overlaps the protrusion of the at least one of the first sub-pixel electrode and the second sub-pixel electrode.

11. The liquid crystal display of claim **1**, further comprising:
color filters overlapping the pixel electrode, edges of which overlap each other and the data line.

12. The liquid crystal display of claim **11**, wherein:
the shielding electrode member overlaps the overlapping edges of the color filters.

13. The liquid crystal display of claim **1**, wherein:
the shielding electrode member and the pixel electrode are in a same layer of the first display panel among layers on the first insulating substrate and include a same material.

14. The liquid crystal display of claim **1**, further comprising a second display panel facing the first display panel, the second display panel comprising:
a second insulating substrate;
a common electrode on the second insulating substrate; and
a liquid crystal layer between the pixel electrode of the first display panel and the common electrode of the second display panel.

15. The liquid crystal display of claim **14**, wherein:
the shielding electrode member receives with a same voltage as that received by the common electrode.

16. A method of manufacturing a liquid crystal display, comprising:

providing a first display panel comprising:

disposing a gate line and a data line on a first insulating substrate, the gate and data lines intersecting each other and being insulated from each other;

disposing a thin film transistor connected to the gate line and the data line;

disposing a pixel electrode connected to the thin film transistor, the pixel electrode including a first sub-pixel electrode and a second sub-pixel electrode spaced apart from each other;

disposing a shielding electrode member on the data line, the shielding electrode member including a first shielding electrode and a second shielding electrode respectively at opposing sides of the pixel electrode, each of the first shielding electrode and the second shielding electrode including:

an expanded part between the first sub-pixel electrode and the second sub-pixel electrode, and

a vertical part elongated from the expanded part in a first direction parallel to the data line; and

disposing a light blocking member elongated in a second direction crossing the first direction to overlap the gate line and the thin film transistor,

wherein

a width in the second direction of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode is larger than that of the vertical part, and

opposing edges of the expanded part between the first sub-pixel electrode and the second sub-pixel electrode overlap the elongated light blocking member overlapping the thin film transistor.

17. The method of claim 16, wherein the providing a first display panel further comprises:

disposing pixel electrodes adjacent to each other in the second direction, and

disposing color filters adjacent to each other in the second direction,

wherein

edges of the second direction adjacent color filters are disposed between the second direction adjacent pixel electrodes and overlapping each other, and

the vertical part of the shielding electrode member overlaps the overlapping edges of the second direction adjacent color filters disposed between the second direction adjacent pixel electrodes.

18. The method of claim 16, wherein

the disposing a shielding electrode member on the data line comprises extending one of the expanded parts between the first sub-pixel electrode and the second sub-pixel electrode spaced apart from each other in the first direction, and

the disposing a pixel electrode connected to the thin film transistor comprises providing one of the first sub-pixel electrode and the second sub-pixel electrode with a protrusion protruding toward the gate line.

19. The method of claim 18, wherein the providing a first display panel further comprises:

disposing a reference voltage line on the first insulating substrate; and

defining a plurality of contact holes respectively exposing the thin film transistor and the reference voltage line,

wherein at least one protrusion of the pixel electrode and the extension of the shielding electrode member overlaps a contact hole among the plurality of contact holes.

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